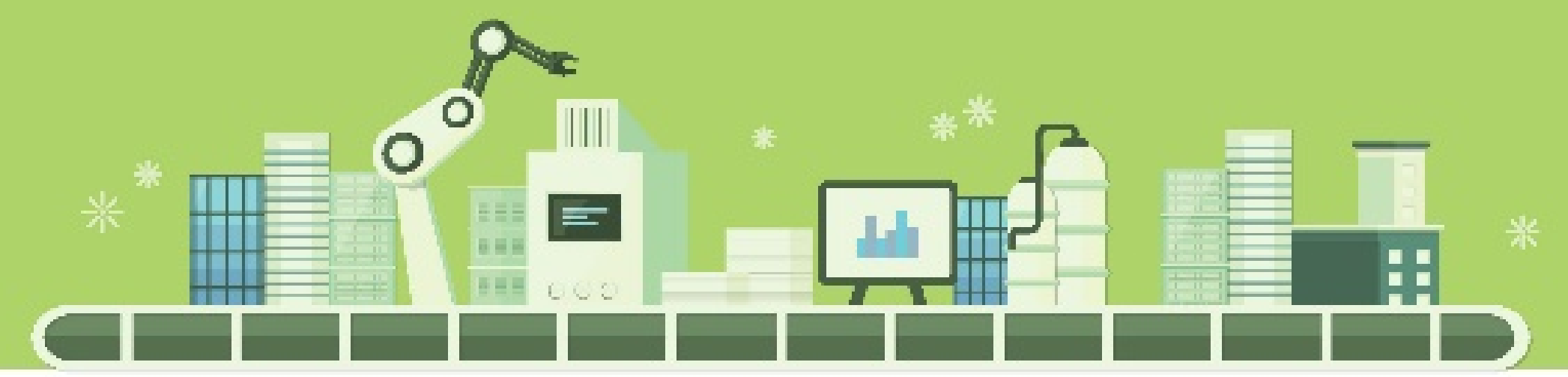




TDMA Noise-Immune DC-DC Boost Converter with Dead-Time Controller for AMOLED Displays

Tae-Un Kim, Ho-Yong Choi

Department of Semiconductor Engineering, Chungbuk National University

1. Introduction

- DC-DC converters for wearable AMOLED display are required to reduce dead time and TDMA noise.

TDMA noise : periodical voltage drop due to TDMA causes overshoot and undershoot of output voltage
→ **Degrades AMOLED display quality**

Dead time : time interval both NMOS and PMOS turn-off time causes body-diode conduction loss
→ **Decreases power efficiency**

2. Circuit Design

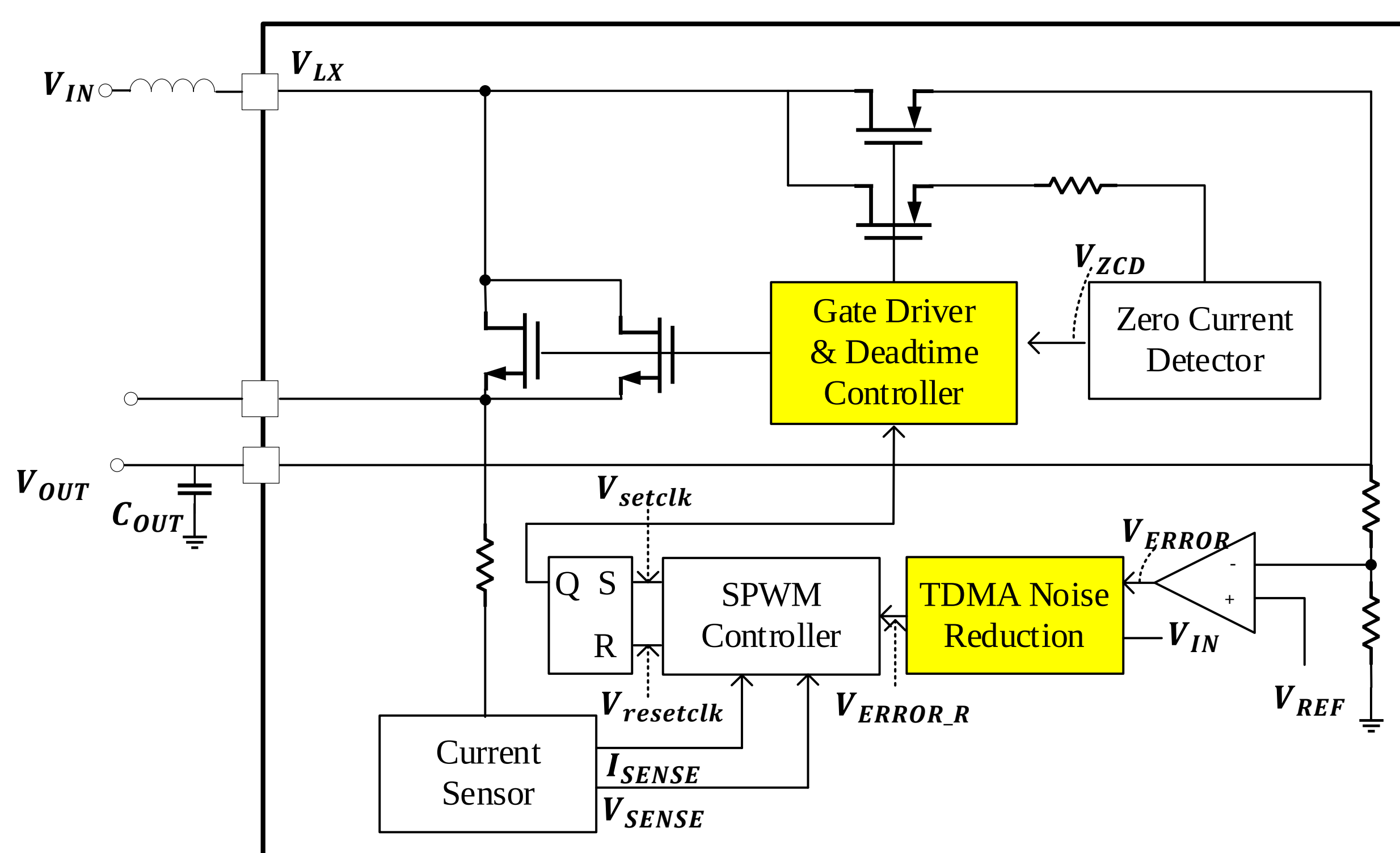


Fig 1. Block diagram of proposed DC-DC boost converter.

- This paper proposes **TDMA noise reduction circuit to reduce TDMA noise** and **dead time controller to increase power efficiency**

2.1. TDMA Noise Reduction Circuit

- TDMA noise reduction circuit replaces original signal V_{ERROR} to V_{ERROR_R}
- V_{ERROR} : Original signal generating a reset clock affected by TDMA noise
- V_{ERROR_R} : New signal generating a reset clock **less affected by TDMA noise**

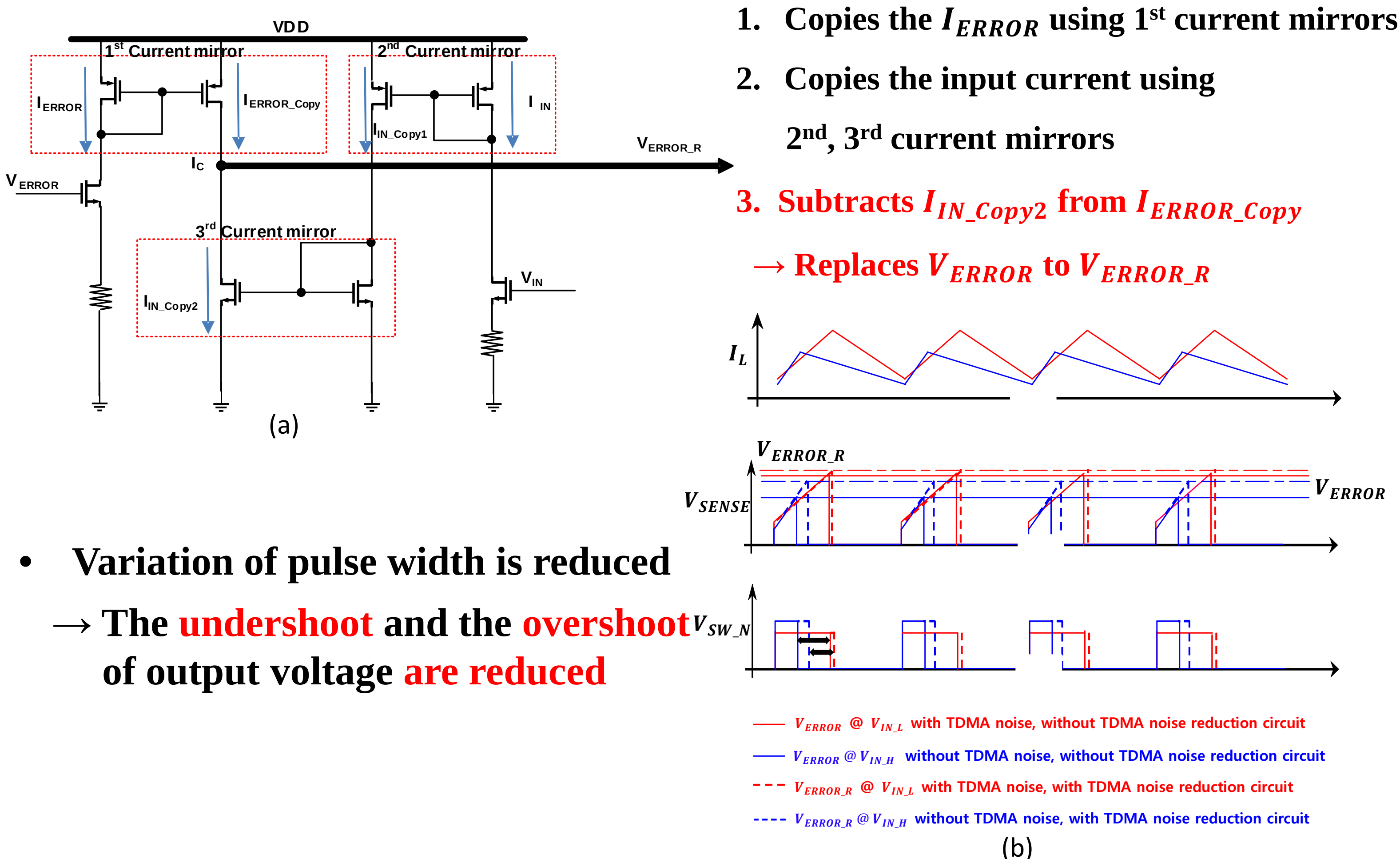


Fig 2. (a) TDMA noise reduction circuit, (b) operation of TDMA noise reduction circuit.

2.2 Dead time controller

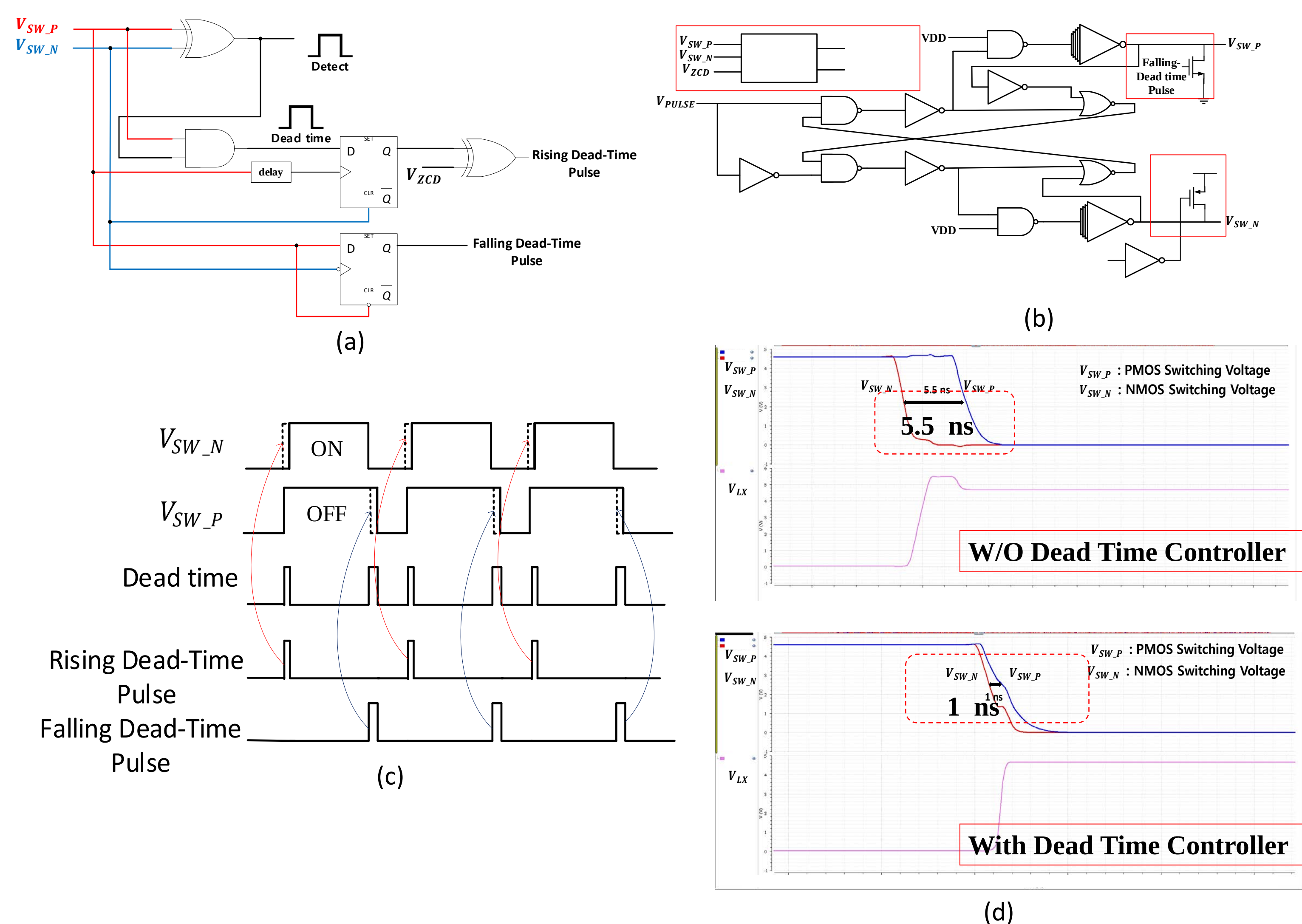


Fig 3. Dead time controller (a) dead time detector, (b) gate driver with dead time controller, (c) waveform of dead time controller, (d) simulation result of dead time controller.

3. Results

Item	Summary
Process	0.18 μ m BCDMOS
Input voltage	2.9 V ~ 4.4 V
Output voltage	4.6 V
Load Current	1 mA ~ 100 mA
Frequency	0.15 MHz ~ 1 MHz
Output ripple	< 5mV
Chip size	0.7 mm X 1.4 mm

Table 1. Summary of proposed DC-DC converter.

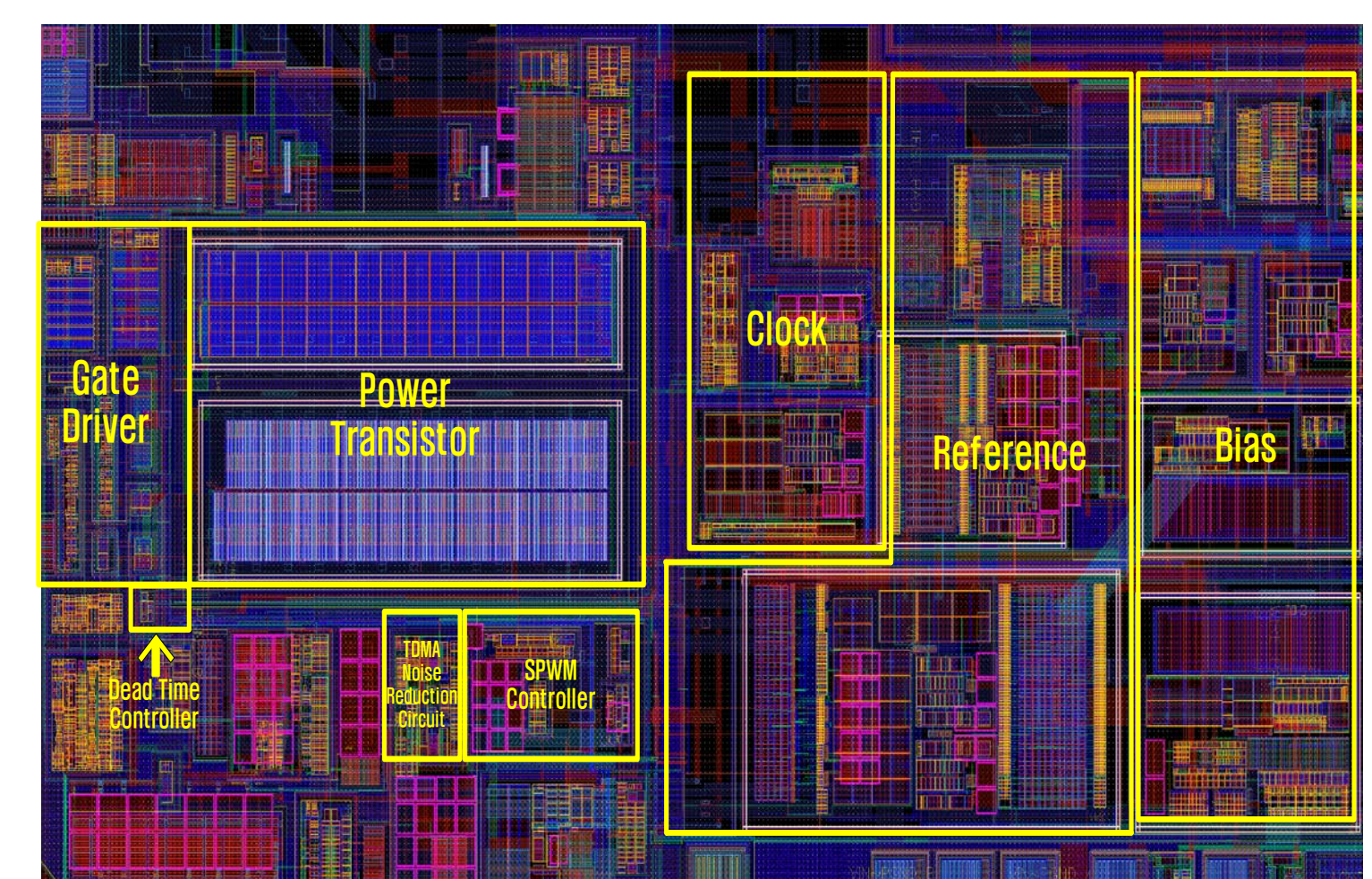


Fig 4. Chip layout.

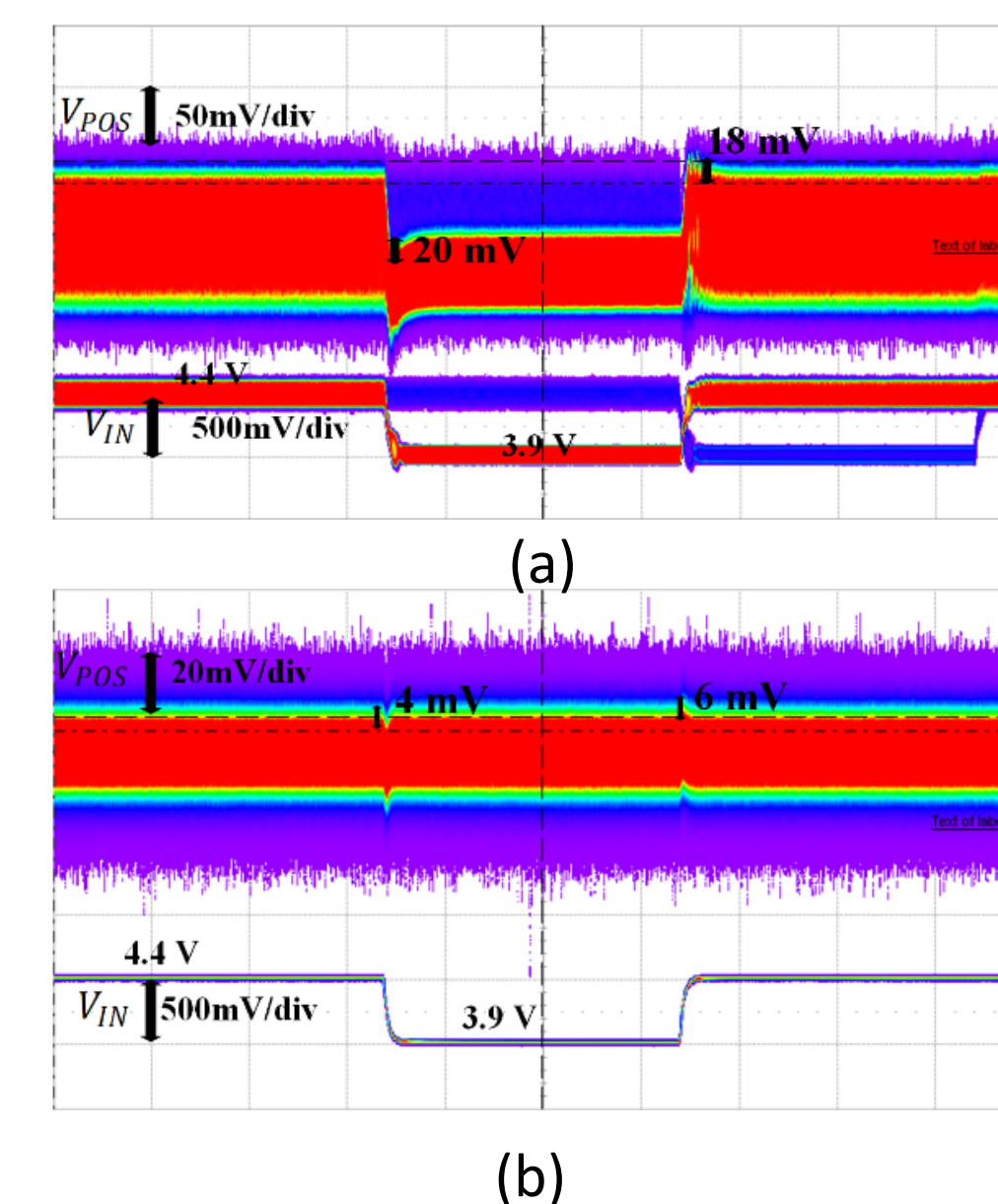


Fig 5. TDMA noise. (a) boost converter without TDMA noise-reduction circuit, (b) proposed boost converter with TDMA noise-reduction circuit @ $I_{LOAD} = 100$ mA.

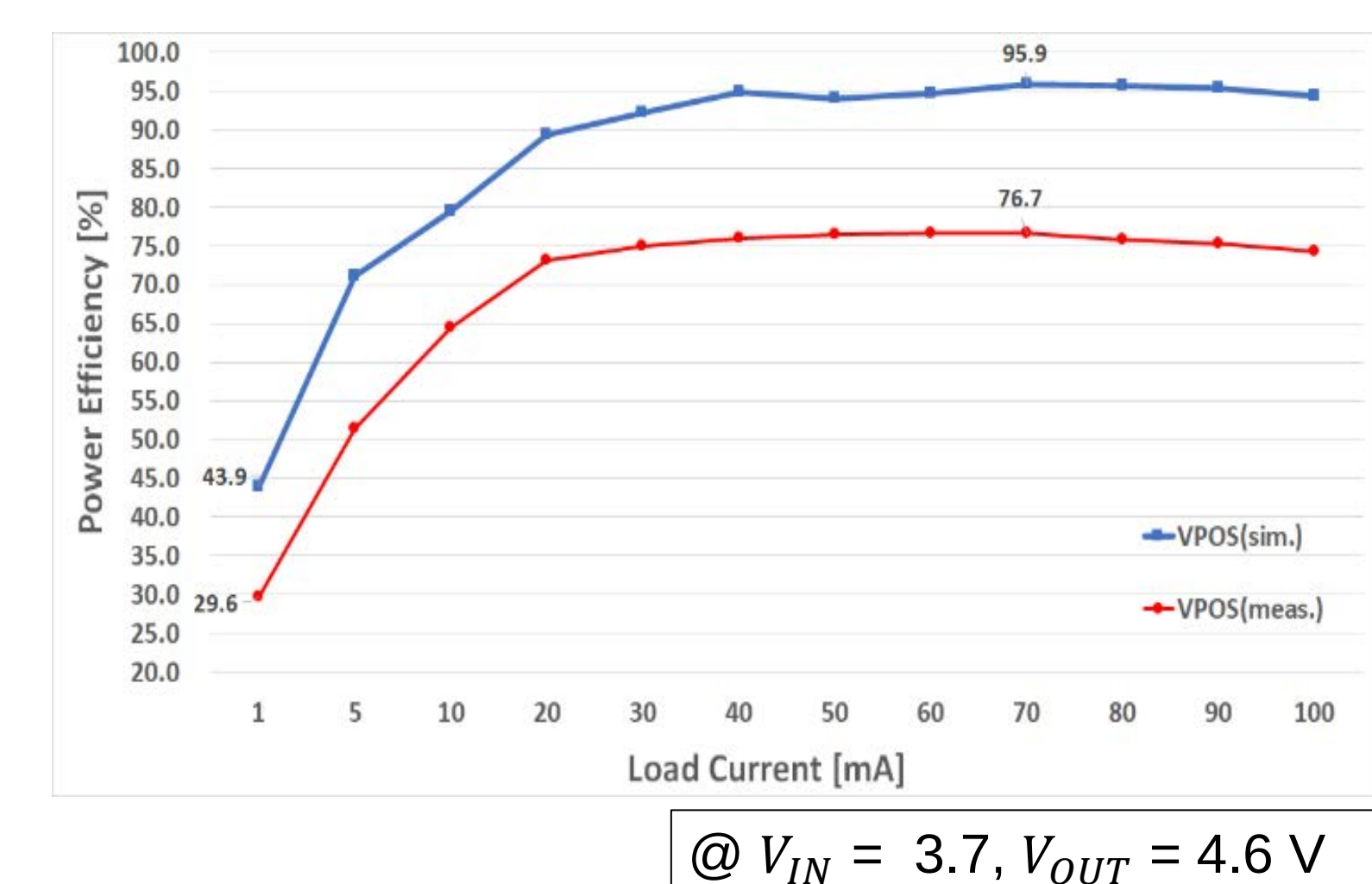


Fig 6. Power Efficiency.

→ The **undershoot** and the **overshoot** are reduced due to **TDMA noise reduction circuit**

4. Conclusion

- TDMA noise reduction circuit reduced undershoot and overshoot by 4 mV, 6 mV.
- The dead time controller controlled to keep dead time at 1 ns.
- Measured power efficiency was 29.6% ~ 76.7%.
- Due to wiring resistance of COB, the converter has low efficiency compared to simulation.